

28744/WO/1

Official file ref: PCT/EP2004/011454

DaimlerChrysler AG

## Tool and method for cutting a hollow profile

5 The invention relates to a tool for cutting a hollow profile according to the preamble of claim 1 and to an associated method according to the preamble of claim 9.

DE 197 24 037 C2 discloses such a method and such a 10 device for cutting a hollow body. The known method is based on the combined application of mechanical cutting of a flange on the hollow body along a first cutting edge and of internal high pressure cutting along a second cutting edge. In this case, the fact that the hollow body 15 is deformed according to the internal high pressure forming process is utilized to the effect that the hollow body is severed transversely to its longitudinal extent preferably after internal high pressure forming has already been effected. During internal high pressure 20 forming, a side of a cutting device used for cutting the flange, this side facing the hollow body, serves as a die wall, against which the hollow body bears during the internal high pressure forming.

25 A device or a method of this type is based on the general idea of designing a tool both for cutting a flange on a hollow profile and for forming the hollow profile according to the internal high pressure forming process, the tool having at least one cutting device which is 30 displaceable in the transverse direction of the hollow profile and runs parallel to the longitudinal extent. A side of the cutting device facing the hollow profile is in this case designed as a shaping die wall, against which the hollow profile bears after the cutting 35 operation and during the internal high pressure forming

following said cutting operation.

With a cutting edge formed on the cutting device, the tool therefore at least partly cuts off a flange, running 5 in the longitudinal direction of the hollow profile, parallel to the longitudinal direction by the cutting edge being displaced in the transverse direction of the hollow profile. After the flange has been cut off, that side of the device which faces the hollow profile is 10 utilized as a shaping die wall, against which the hollow profile then bears with an outer side during the internal high pressure forming. In this case, the tool makes provision for a cutting operation on the hollow profile blank to be completed before the internal high pressure 15 forming operation starts.

This type of construction or procedure therefore offers the advantage that two method steps, namely the cutting of the flange and the subsequent internal high pressure 20 forming, can be effected in one production step in a single tool, thereby resulting in a rationalized production sequence. The production process is therefore streamlined, which helps to achieve time or cost advantages.

25

DE 100 30 882 A1 discloses a precision cutting method and an associated device. To this end, a punching strip, in a first embossing step, is supported against a fixed surface by means of at least one hold-down, and the 30 subsequent finished part is pressed at the same time or with a time delay into an embossing die, preferably against the spring force of a spring base. In the process, a sliding surface is produced on the lateral

surfaces of the subsequent finished part. In a second parting step following the embossing step, the punching strip is thereupon supported on a fixed surface by at least one hold-down and then the subsequent finished part 5 is cut out with a parting punch in a parting die.

DE 199 01 304 A1 discloses a method of processing workpieces. In this case, essentially vertically moving processing tools are arranged at at least one station and 10 essentially horizontally moving processing tools are arranged at at least one further station, these processing tools acting on the workpieces. In the process, at least two workpieces preferably arranged axially symmetrically to one another and leaving a 15 clearance space between them are processed simultaneously in each station. Furthermore, a device suitable for carrying out the method has been disclosed. The device, which is designed as a press tool for example, makes it possible, for example after the deep drawing of a sheet- 20 metal workpiece, to carry out the cutting/perforating operations, following said deep drawing, on spatially differently oriented surfaces of the workpiece and thus increase the capacity of the device.

25 DE 40 35 938 A1 discloses a press tool with multiple movements, having a punch and die which are movable relative to one another due to the movement of the punch. Arranged opposite the punch inside the die is a counter 30 punch which can be moved independently and with a variable force via hydraulic cylinders accommodated in the tool. In addition, or alternatively, a counter die is arranged opposite the die adjacent to the punch in the tool, this counter die likewise being movable

independently and with a variable force via hydraulic cylinders accommodated in the tool. It is crucial in this case that the counter punch can be moved as part of the tool independently therefrom and with any desired and 5 adjustable force, a factor which defines an additional movement. This counter punch is part of the tool, so a tool with multiple movements is now produced by the additional movement.

10 DE 101 36 792 A1 discloses a tool for trimming drawn parts.

15 The present invention deals with the problem of specifying an improved embodiment for a method and a device of the type mentioned at the beginning, with which improved embodiment in particular a rationalized production process can be achieved.

20 This problem is solved according to the invention by the subject matters of the independent claims. Advantageous embodiments are the subject matter of the dependent claims.

25 By means of the positioning device proposed according to the invention, quality and reproducibility of both the cutting operation and the forming operation are improved, the degree of automation of the cutting and forming operation being increased at the same time.

30 According to a development of the solution according to the invention, the tool has a bottom die and a top die which are displaceable relative to one another. In this case, either the cutting device is integrated in one of

the dies and the cutting edge then forms an integral part of the respective die, or else the cutting edge is designed as a separate component and is fastened to one of the dies in a fixed position, or else the cutting 5 device is arranged on one of the dies in such a way as to be adjustable in stroke. The variants described of the arrangement of the cutting device on the tool already shows the wide range of possibilities that the invention opens up with regard to process-optimized arrangement 10 variants of the cutting devices. For example, a design of the cutting device as a separate component which is fastened to one of the dies in a fixed position offers the advantage that, after a relatively large number of cutting operations, the cutting device or the cutting 15 edge can be exchanged simply and quickly and thus the maintenance cost of the tool can be reduced. If the cutting device is arranged on one of the dies in such a way as to be adjustable in stroke, a markedly smoother mode of operation of the tool is obtained on account of the lower weight, to be moved, of the cutting device 20 compared with the top or bottom die. On the other hand, the integration of the cutting device in one of the dies or the design of the cutting edge as an integral component offers the advantage that an especially precise 25 and powerful cutting operation can be achieved as a result. Due to the many possible ways of arranging the cutting devices on one of the dies, the solution according to the invention therefore makes it possible to react in a flexible manner to the most varied 30 requirements with regard to the material and/or workpiece to be processed.

According to a preferred embodiment of the invention, at

least one hold-down, which fixes the flange of the hollow profile at least during the cutting operation, is provided in the region of the cutting edge. Such a hold-down, in combination with a positioning device which, 5 before and during the cutting and forming operation, presses the hollow profile against that side of the cutting device which faces the hollow profile, ensures that the hollow profile is held in a fixed position during the cutting operation and thus ensures an exact 10 cut of high quality. In addition, the hold-down provides for always identical positioning of the hollow profile inside the tool, as a result of which a high reproducible dimensional accuracy and thus uniformity of the hollow profiles to be produced is achieved.

15

An embossing punch may expediently be provided which is displaceable transversely to the longitudinal extent of the hollow profile and which makes an embossment on the outside of the hollow profile after the forming 20 operation. In this way, the solution according to the invention, in addition to a cutting and internal high pressure forming operation, offers the advantage of carrying out an embossing operation virtually simultaneously, but in particular without a tool change, 25 so that a further production step with the tool according to the invention can be integrated in the respective work station. In this case, the embossing punch may be arranged in such a way that it crosses and passes through the cutting device in a corresponding opening during the 30 embossing operation. In the process, the embossing punch embosses an outer side, bearing against the die wall of the cutting device,

DaimlerChrysler AG

Patent claims

5 1. A tool (1) for cutting a hollow profile (2),  
- the tool (1) being designed for cutting a flange (3) on  
the hollow profile (2),  
- the tool (1) also being designed for forming the hollow  
profile (2) according to the internal high pressure  
10 forming process,  
- the tool (1) having at least one cutting device (4)  
which runs parallel to the longitudinal extent, has a  
cutting edge (5) and is displaceable in the transverse  
direction of the hollow profile (2),  
15 - a side (6) of the cutting device (4) facing the hollow  
profile (2) being designed as a shaping die wall (17),  
against which the hollow profile (2) bears at least  
during the internal high pressure forming,  
characterized in that a positioning device (9) is  
20 provided which, before the cutting and forming operation,  
presses the hollow profile (2) against that side (6) of  
the cutting device (4) which faces the hollow profile  
(2).

25 2. The tool as claimed in claim 1, characterized in  
that the tool (1) has a bottom die (7) and a top die (8)  
which are displaceable relative to one another.

30 3. The tool as claimed in claim 2, characterized in  
that  
- the cutting device (4) is integrated in one of the dies  
(7, 8) and the cutting edge (5) forms an integral part  
of the respective die (7, 8), or  
- the cutting device (4) is designed as a separate

component and is fastened to one of the dies (7, 8) in a fixed position, or

- the cutting device (4) is arranged on one of the dies (7, 8) in such a way as to be adjustable in stroke.

5

4. The tool as claimed in one of claims 1 to 3, characterized in that at least one hold-down (10), which fixes the flange (3) of the hollow profile (2) at least during the cutting operation, is provided in the region 10 of the cutting edge (5).

5. The tool as claimed in one of claims 1 to 4, characterized in that an embossing punch (11) is provided which is displaceable transversely to the longitudinal 15 extent of the hollow profile (2) and which makes an embossment on the outside of the hollow profile (2) after the forming operation.

6. The tool as claimed in claim 5, characterized in 20 that the embossing punch (11) is arranged in such a way that it crosses and passes through the cutting device (4) in a corresponding opening (12) during the embossing operation.

25 7. The tool as claimed in either of claims 5 and 6, characterized in that at least one perforating punch (13) is provided in the embossing punch (11) coaxially thereto, this perforating punch (13) perforating the hollow profile (2) after the embossing operation has been 30 completed.

8. A method of cutting a hollow profile,

- a flange (2) on the hollow profile (2) being cut by

means of a cutting device (4) which runs parallel to the longitudinal extent of the hollow profile (2) and has a cutting edge (5) which is displaced transversely to the longitudinal extent of the hollow profile (2),

5 - the hollow profile (2), after the cutting operation, bearing during the internal high pressure forming against that side (6) of the cutting device (4) which faces the hollow profile (2) and which is designed as a shaping die wall,

10 characterized in that, before the cutting and forming operation, a positioning device (9) presses the hollow profile (2) against that side (6) of the cutting device (4) which faces the hollow profile (2).

15 9. The method as claimed in claim 8, characterized in that at least one hold-down (10) arranged in the region of the cutting edge (5) fixes the flange (3) of the hollow profile (2) at least during the cutting operation.

20 10. The method as claimed in claim 8 or 9, characterized in that the flange (3) is cut by closing the tool (1).

11. The method as claimed in one of claims 8 to 10, characterized in that an embossing punch (11) 25 displaceable transversely to the longitudinal extent of the hollow profile (2) makes an embossment on the outside of the hollow profile (2) after the forming operation.

30 12. The method as claimed in claim 11, characterized in that the embossing punch (11) crosses and passes through the cutting device (4) during the embossing operation.

13. The method as claimed in claim 11 or 12,

characterized in that at least one perforating punch (13) arranged in the embossing punch (11) coaxially thereto perforates the hollow profile (2) before or after the embossing operation.